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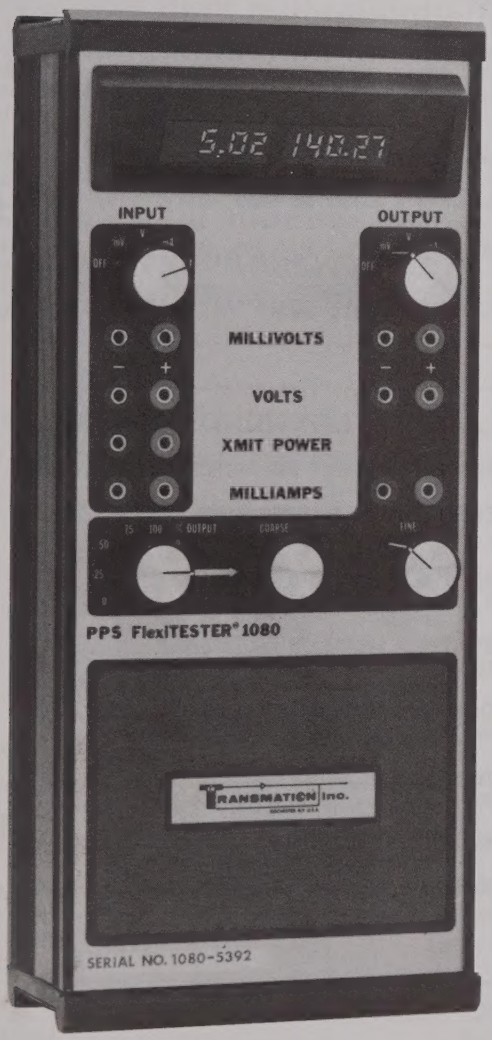
INSTRUCTION MANUAL



MODEL 1080 FLEXITESTER®

MICROCOMPUTER-BASED DIGITAL CALIBRATOR AND SIGNAL INDICATOR

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Analysis • Specifications • Design • Production

TRANSMATION inc.
977 MT. READ BLVD. □ P.O. BOX 7803 □ ROCHESTER, NEW YORK U.S.A. 14606
TELEX 97-8314 (TRANSMAT ROC) □ TELEPHONE (01) 716-254-9000

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1. GENERAL INFORMATION

1.1 DESCRIPTION

This manual describes the Transmation Model 1080 FlexiTESTER®, a field-portable, microcomputer-based digital calibrator and signal indicator. The FlexiTESTER® generates test signals and measures unknown process signals within a millivolt, volt or milliamp range to test and/or calibrate process instrumentation. Mode of operation (input, output or both) and signal range are switch-selectable via two sets of front panel controls: one set for input and the other for output.

There is a separate set of I/O terminals on the front panel for each of the available signal ranges. This permits the user to connect a number of test devices to the FlexiTESTER® simultaneously. The mode of operation and the signal range can be changed to suit each individual device, one at a time, without having to disconnect the other devices. Further, the input side is completely independent of the output side so that the input and output modes can be used simultaneously (e.g. to apply a mV test signal to a transmitter and measure the transmitter's resulting mA output as shown in Figures 2-8a and 2-8b on page 8). The FlexiTESTER® can be inserted into a process loop and use an existing loop power supply (up to 100 VDC) or it can provide isolated, unregulated 24 VDC from its own circuitry to power a loop.

The FlexiTESTER® is powered by rechargeable/replaceable nickel-cadmium batteries. Input-to-output isolation is built into the FlexiTESTER®'s circuitry. The circuitry is protected against misconnections and overvoltages of up to 120 VAC, without fuses or circuit breakers. Sealed relays with gold contacts are used to insure reliable signal transmission in harsh corrosive atmospheres. The instrument case has interlocking extrusions to protect against light rain or mist. A padded vinyl carrying case, test leads and two 5-way binding post extensions are provided with each unit.

1.2 SPECIFICATIONS

1.2.1 INPUT CHARACTERISTICS PER SIGNAL TYPE:

TYPE	RANGE	IMPEDANCE	RESOLUTION (% FULL SCALE)	ACCURACY
mV	-150 to +150 mV	10 megohms	.007%	±.013% Full Scale ± .02% of Reading
V	-75 to +75V	1 megohm	.013%	±.013% Full Scale ± .04% of Reading
mA	-75 to +75 mA	10 ohms	.013%	±.026% Full Scale ± .053% of Reading

1.2.2 OUTPUT CHARACTERISTICS PER SIGNAL TYPE:

TYPE	RANGE	OUTPUT IMPEDANCE	OUTPUT DRIVE CAPABILITY	RESOLUTION (% FULL SCALE)	ACCURACY
mV	0 to 150 mV	0.5 ohms	1 mA max.	.007%	±.013% F.S.* ± .013% of Reading
V	0 to 24V	0.5 ohms	80 mA max.	.042%	±.042% F.S. ± .128% of Reading (less than 1V: add ± 1 L.S.D.)
mA XMIT	0 to 60 mA		mA output: 1.2K ohms max. @ 20 mA XMIT output: 1.1K ohms max. @ 20 mA given 24 VDC power supply Consult Table 1-1 on page 2 for additional information	.017%	±.033% F.S. ± .053% of Reading
DC POWER	Isolated, unregulated loop power supply. 24 VDC @ 50 mA, typical. Current limited @ 75 mA.				

* F.S. = Full Scale

1.2.3 REPEATABILITY: 2 Least Significant Digits

1.2.4 STABILITY: ±0.005% of span for 24 hours; ±0.01% of span for 30 days

1.2.5 COMMON MODE REJECTION: 120 dB @ 50 or 60 Hz, depending on the crystal supplied, with unbalanced input of 1K ohm

1.2.6 NORMAL MODE REJECTION: 60 dB minimum @ 50 or 60 Hz, depending on the crystal supplied

1.2.7 OUTPUT RIPPLE AND NOISE: Not synchronous to line power, less than ±1 Least Significant Digit

1.2.8 ISOLATION: 250 VDC or 250V peak AC input-to-output

1.2.9 OVERVOLTAGE PROTECTION: Thermistor and zener diode protected against misconnections and overvoltages up to 120 VAC

1.2.10 POWER SUPPLY: Rechargeable nickel-cadmium batteries in a Transmation Snap-Pack® Battery Cartridge

1.2.11 CHARGE LIFE: 5 hours continuous in measurement mode, reduced by 1 hour per 20 mA of current drawn by load

1.2.12 BATTERY LIFE: 1000 charge/discharge cycles

1.2.13 LOW BATTERY INDICATOR: At 4.6V, display alternately flashes value and "CHARGE" legend; at 4.5V or less, unit automatically shuts down to prevent cell reversal

1.2.14 WARM-UP TIME: 30 seconds or less to rated accuracy

1.2.15 OPERATING TEMP.: 0°C to 60°C (32°F to 140°F) or -20°C to 60°C (-4°F to 140°F) @ 40% of nominal battery life

1.2.16 STORAGE TEMP.: -40°C to 65°C (-40°F to 150°F)

1.2.17 HUMIDITY: 5% to 95%, noncondensing

1.2.18 AMBIENT TEMP. EFFECT: Span: ±0.0025% of span/°C
Zero: ±1 LSD over recommended temperature range

1.2.19 DISPLAY: Two 6-digit displays in a single vacuum fluorescent tube with decimal point and leading zero blanking; characters approximately 0.5 cm (0.2") high

1.2.20 CASE: Interlocking anodized aluminum extrusions

1.2.21 SIZE (HWD): 241 mm x 114 mm x 68 mm (9.5" x 4.5" x 2.7")

1.2.22 WEIGHT: 1.8 kg (4 lbs.) nominal, including Snap-Pack® Battery Cartridge

1.3 UNPACKING

It is recommended that all packing materials be retained in the event that the instrument must be returned to the factory. The instrument is shipped in its vinyl carrying case with a Transmation Snap-Pack® Battery Cartridge installed. Verify that the shipping carton contains:

- A Model 1080 FlexiTESTER®
- A set of test leads
- A Model 1080 FlexiTESTER® Instruction Manual, I.S. #100776-900
- A Snap-Pack® Battery Cartridge Instruction Manual, I.S. #100724-902
- Thermocouple Conversion Tables

TABLE 1-1
FORMULA FOR CALCULATING MAXIMUM LOOP RESISTANCE IN THE mA OUT MODE

mA OUT MAXIMUM LOOP RESISTANCE:

$$\frac{\text{24 Volts}}{\text{Load Current in Amperes}} = \text{Maximum Loop Resistance in Ohms}$$

e.g. $\frac{24V}{0.06A}$ = 400 ohms

XMIT OUT MAXIMUM LOOP RESISTANCE:

Varies with loop power supply and current output

2. OPERATING INSTRUCTIONS

2.1 OVERVIEW

This section provides instructions for operating the Model 1080 FlexiTESTER®. Section 2.2 describes the various front panel controls and indicators. Section 2.3 contains instructions for checking the batteries, while Section 2.4 details the procedures for correcting a low-voltage supply shutdown. Section 2.5 contains step-by-step instructions for operating the Model 1080 in various test applications. Each set of instructions is accompanied by a connection diagram that illustrates the test circuit configuration. Consult the Table of Contents for an index to the connection diagrams.

2.2 FRONT PANEL CONTROLS AND INDICATORS

There are two sets of control switches, displays and miniature banana plug terminals on the front panel. The function switch, display window and terminals on the left-hand side of the front panel are dedicated to measuring input signals. The same components on the right-hand side of the front panel are dedicated to generating and outputting test signals. The three knobs below the I/O terminals are used in conjunction with the Output Function Switch to adjust the amplitude of the output signals.

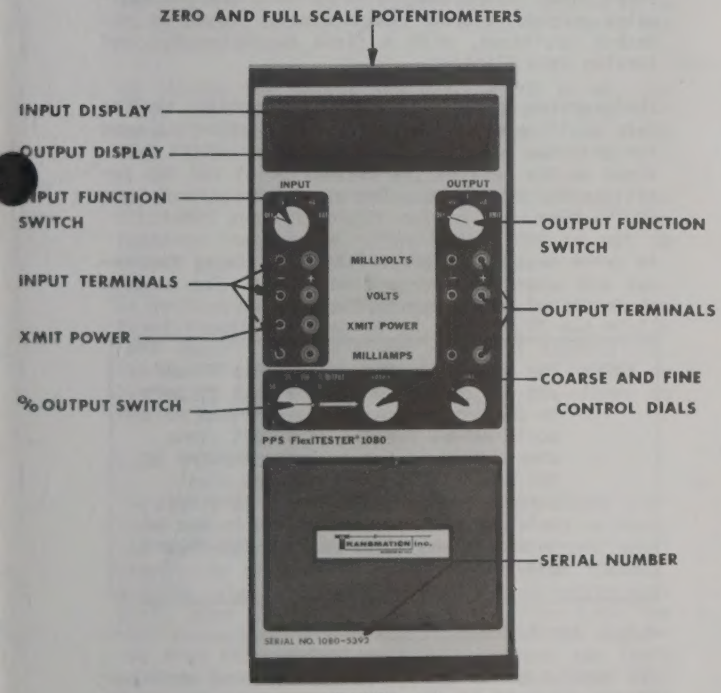

FIGURE 2-1
FRONT PANEL CONTROLS

2.2.1 INPUT FUNCTION SWITCH

The Input Function Switch sets the Model 1080 for measuring an unknown voltage or current signal applied to one of three sets of input terminals. There are five positions on the switch as indicated below.

OFF - disables input side of the Model 1080

mV - sets the Model 1080 for -150 to +150 mV input

V - sets the Model 1080 for -75 to +75V input

mA - sets the Model 1080 for -75 to +75 mA input

BAT - measures and displays logic supply voltage which is approximately equal to battery voltage

2.2.2 OUTPUT FUNCTION SWITCH

The Output Function Switch sets the Model 1080 for generating a test signal (voltage/current). The switch has five positions as indicated below.

OFF - disables output side of the Model 1080

mV - provides DC output within 0 to +150 mV range (live zero)

V - provides DC output within 0 to +24V range (live zero)

mA - provides DC output within 0 to +60 mA range

XMIT - simulates a two-wire transmitter, permits the Model 1080 to be inserted into a process loop using an existing loop power supply (up to 100 VDC), provides a 0 to 60 mA output

The exact amplitude of the output signal is controlled by either the Percent Output Switch or the Coarse and Fine Control Knobs.

2.2.3 PERCENT OUTPUT SWITCH

The Percent Output Switch increases or decreases the output signal by discrete steps as the switch is rotated from position to position. There are six fixed percent positions: 0%, 25%, 50%, 75%, 100% and 0%. When using the Percent Output Switch to adjust the output signal, the zero (0%) and full scale (100%) values for the range selected on the Output Function Switch must be established by adjusting the zero and full scale potentiometers on the top of the instrument (see Section 2.2.4).

Each clockwise step on the Percent Output Switch, from 0% to 100%, increases the test signal output by 25% of the span (full scale value minus zero value) set by the potentiometers. Refer to the example on page 4.

EXAMPLE:

If the Output Function Switch is set to mA, and the zero and full scale values are set to 4 mA and 20 mA, respectively (16 mA span), the Percent Output Switch will produce output signals per position as follows:

SWITCH POSITION	OUTPUT SIGNAL
0%	4 mA
25%	8 mA
50%	12 mA
75%	16 mA
100%	20 mA

There are two 0% positions. The 0% position adjacent to the 100% position permits convenient adjustment from 0% to 100% while bypassing the intermediate increments.

The "⇨" (Continuous) position on the switch transfers control of the output signal amplitude from the Percent Output Switch to the Coarse and Fine Control knobs (Section 2.2.5). These knobs can be used to adjust the output to any value within the specified limits of each output range (mV, V or mA) in a continuous manner.

2.2.4 ZERO/FULL SCALE POTENTIOMETERS

The zero (0%) and full scale (100%) values for each output range can be set via the four screwdriver-adjustable potentiometers on the top of the instrument. There is a coarse control pot and a fine control pot for each of the two values. The pots are located beneath a sliding panel. To gain access to the pots, slide the panel to the right until the screws are exposed through their respective holes (see Figure 2-2 below).

FIGURE 2-2
TOP VIEW - ZERO/FULL SCALE POTS

Zero and full scale are continuously adjustable to any values within the limits specified for the range selected (Specification 1.2.2, page 1). Set the Percent Output Switch to 0% when adjusting the zero pots and to 100% when adjusting the full scale pots. Set the Output Function Switch to the desired range. The adjustment ranges for the coarse and fine pots are identical to those for the Coarse and Fine knobs, as indicated in Table 2-1.

2.2.5 COARSE AND FINE CONTROL KNOBS

The Coarse and Fine Control Knobs are functional only when the Percent Output Switch is set to Continuous. The knobs are NOT affected by the zero and full scale potentiometers described in Section 2.2.4. Both knobs are 3-turn potentiometers.

The table below indicates the output adjustment ranges of the Coarse and Fine controls for each of the output ranges.

TABLE 2-1

OUTPUT RANGE	COARSE	FINE
mV Out	Live Zero to 150 mV	2.5 mV Span
Volts Out	Live Zero to 24V	0.45V Span
mA Out	Live Zero to 60 mA	0.25 mA Span

2.2.6 FRONT PANEL DISPLAYS

There are two identical vacuum fluorescent displays on the front panel. The left-hand display indicates input values and the right-hand display indicates output values. Each display contains six decade positions, with a fixed decimal point and leading zero blanking.

The negative value indicator (-) appears in the far left position when required. No indicator is used for positive values. There are three digit positions to the left of the decimal point and two positions to the right. The characters are 0.5 cm (0.2") high.

An error message (ERROR) will be displayed for input and output overrange conditions. The message is indicated at the appropriate display.

NOTE: The Output Display will show a mA output value ONLY when the output circuit is complete. To set the zero and full scale values for the mA output range when a test device is not connected to the Model 1080, use a current shunt across the MILLIAMPS output terminals to close the circuit and enable the mA output values to be read at the Output Display.

2.2.7 INPUT/OUTPUT TERMINALS

The Model 1080 is equipped with a pair of miniature banana plug terminals for each input and output range. The input terminals are located on the left side of the front panel and the output terminals are located on the right side.

The terminals are labeled MILLIVOLTS, VOLTS or MILLIAMPS, according to the signal ranges for which they are used. The terminals to be used must match the range to be selected on the Function Switch.

The XMIT POWER terminals can be used to provide isolated unregulated 24 VDC to power a process loop and/or any low power instruments within the loop, such as a two-wire transmitter (see the applicable figures on pages 7 and 8 for proper connections and Function Switch settings). This built-in power supply eliminates the need to provide a separate external power supply when testing instruments outside of their normal process loops.

Various instruments under test, each using a different signal range, can be connected to their respective input and/or output terminals simultaneously.

One set of input and/or one set of output terminals can be in service at one time. If a number of devices under test, each using a different signal range, are connected to their respective input and/or output terminals simultaneously, service can be switched back and forth between the different terminals without having to disconnect the devices. The terminals not in service are internally disconnected as the Function Switch, Input or Output, is rotated from range to range.

EXAMPLE:

Connect Device #1 to MILLIAMPS output, Device #2 to VOLTS output and Device #3 to MILLIAMPS input and MILLIVOLTS output.

By setting the Output Function Switch to mA, the VOLTS and MILLIVOLTS output terminals will be internally disconnected and inoperative. The Model 1080 is set to output a mA signal to Device #1.

By setting the Output Function Switch to V, the MILLIAMPS and MILLIVOLTS output terminals will be rendered inoperative. The Model 1080 is set to output a voltage signal to Device #2.

By setting the Output Function Switch to mV and the Input Function Switch to mA, the VOLTS and MILLIAMPS output terminals are rendered inoperative. The Model 1080 is set to output a mV signal to Device #3 and measure the resulting mA signal at the MILLIAMPS input terminals.

2.3. BATTERY CHECK

The Model 1080 has a built-in battery check circuit. When the logic voltage equals 4.6V or less, the battery check circuit causes the front panel display to alternately flash the message "CHARGE" and the value(s) being monitored (input and/or output). When the logic voltage falls below 4.5V, the unit automatically shuts off to prevent the batteries from discharging completely. Check the logic voltage prior to operating the instrument as follows. Set the Input Function Switch to the BAT position and read the value indicated on the Input Display. A reading of greater than 4.6V indicates sufficient charge for operation. If the display reads 4.6V or less, the batteries require recharging (see Section 4.2).

Total discharge may cause cell reversal. To assure that cell reversal does not occur, recharge the batteries immediately when low voltage (4.6V) is indicated.

2.4 CORRECTING LOW SUPPLY VOLTAGE SHUTDOWN

In protecting itself against low supply voltage and possible internal damage, the Model 1080 will shut itself down under certain conditions. These conditions include:

- Sudden overload on voltage output, current output or 24 VDC supply.
- Temporary loss of supply voltage due to excessive shock or when switchover from battery to power supply occurs (during recharge).
- Inadequate battery or line power supply conditions.

To recover from this protective condition, use the procedure described below.

1. Turn both Function Switches to their OFF positions.
2. Briefly remove the Snap-Pack® cartridge and then reinsert it in the Model 1080.
3. Set each Function Switch back to the desired function.

To avoid temporary loss of power when recharging the Model 1080 in a Tilt-Base™ Charger, it is recommended that the following steps be observed:

1. Prior to inserting the Model 1080 into the Tilt-Base™ cradle, turn the Model 1080 and Tilt-Base™ power switches OFF.
2. Insert the Model 1080 into the Tilt-Base™ cradle.
3. Turn the Tilt-Base™ Charger ON.
4. Turn the Model 1080 Function Switches to the desired functions.

2.5 OPERATING INSTRUCTIONS

Step-by-step instructions and connection diagrams for operating the Model 1080 in various test applications are listed on pages 6 through 10. Consult the Table of Contents for an index to the connection diagrams.

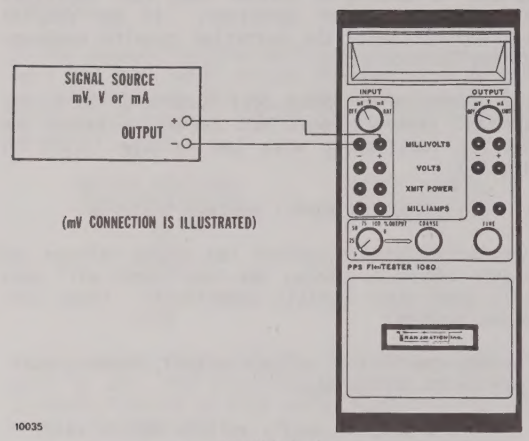

FIGURE 2-3
MODEL 1080 AS A MILLIVOLT/VOLT/MILLIAMP METER

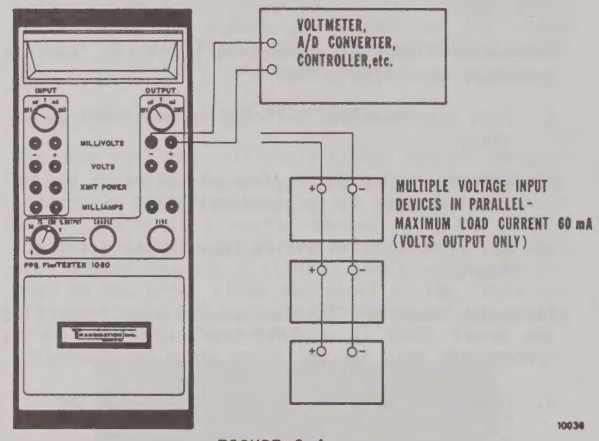

FIGURE 2-4
MODEL 1080 AS A VOLTAGE SOURCE

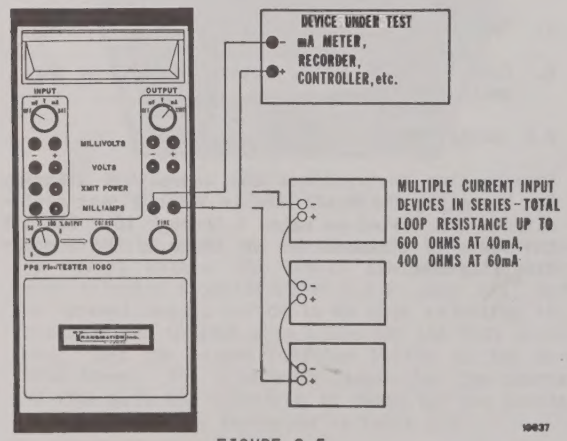

FIGURE 2-5
MODEL 1080 AS A CURRENT SOURCE

2.5.1 USING THE MODEL 1080 AS A MILLIVOLT/VOLT/ MILLIAMP METER

1. Connect the signal source under test to the appropriate Model 1080 input terminals (mV, V or mA), positive (+) to positive and negative (-) to negative. If the polarities are reversed, the Input Display will read a negative value.
2. Set the Input Function Switch to the appropriate range (mV, V or mA) matching the signal source's output.
3. Read the input signal value on the Input Display.

2.5.2 USING THE MODEL 1080 AS A VOLTAGE SOURCE

1. Use the zero and full scale potentiometers (Section 2.2.4) to set the zero and full scale values for the output range to be selected (mV or V).

NOTE: Adjustment of the zero and full scale potentiometers is necessary only when using the Percent Output Switch to adjust the output signal.

2. Connect the voltage input device(s) to the Model 1080 MILLIVOLTS or VOLTS output terminals (whichever is applicable) and set the Output Function Switch to mV or V accordingly.
3. Use either the Percent Output Switch (Section 2.2.3) or the Coarse and Fine Controls (Section 2.2.5) to adjust the output value as required.
4. Monitor the output signal on the Output Display.

2.5.3 USING THE MODEL 1080 AS A CURRENT SOURCE

See the CAUTION note at the top of page 7.

1. Connect the current input device(s) to the Model 1080 MILLIAMPS output terminals and set the Output Function Switch to mA.
2. Use the zero and full scale potentiometers (Section 2.2.4) to set the zero and full scale values for the mA output range (if using the Percent Output Switch).
3. Use either the Percent Output Switch (Section 2.2.3) or the Coarse and Fine controls (Section 2.2.5) to adjust the mA output to the required value.
4. Monitor the output signal on the Output Display.

CAUTION:

A momentary current spike of up to 1 ampere with a duration of about 1 microsecond will occur if the Coarse and Fine controls are not set for zero output when connecting a load to the MILLIAMPS output terminals with the Output Function Switch set at either mA or XMIT. This current spike may blow any fuses that are present in the output loop. To prevent blowing fuses, turn the Percent Output Switch to "⇨" (Continuous) and the Coarse and Fine controls down to zero output prior to connecting the load.

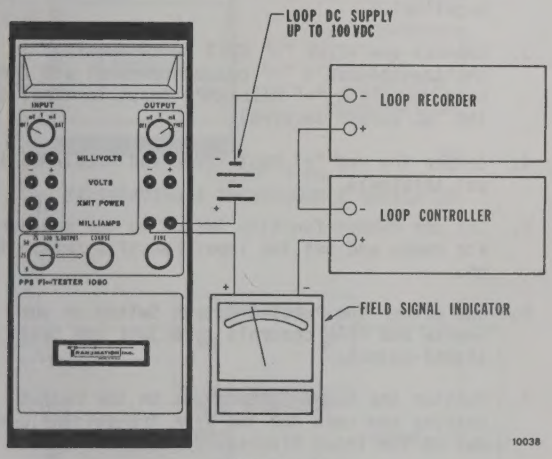

FIGURE 2-6
SIMULATING A TWO-WIRE TRANSMITTER

2.5.4 SIMULATING A TWO-WIRE TRANSMITTER

1. Set the Output Function Switch to XMIT (refer to the CAUTION above).
2. Connect the red "+" MILLIAMPS output terminal to the "+" side of the loop power supply and connect the black "-" MILLIAMPS output terminal to the "+" terminal of a loop device.
3. Use the zero and full scale potentiometers (Section 2.2.4) to set the zero and full scale values for the XMIT output range (if using the Percent Output Switch).
4. Adjust the mA output using either the Percent Output Switch (Section 2.2.3) or the Coarse and Fine Controls (Section 2.2.5).
5. Monitor the output signal on the Output Display.

NOTE: If a DC power supply is not available, use the mA output configuration depicted in Figure 2-5 and set the Output Function Switch to mA.

2.5.5 MONITORING AND POWERING A TWO-WIRE TRANSMITTER

1. Connect the black "-" XMIT POWER terminal to the "-" output terminal on the two-wire transmitter.
2. Connect the black "-" MILLIAMPS input terminal to the "+" output terminal on the two-wire transmitter.
3. Jumper the red "+" XMIT POWER terminal to the red "+" MILLIAMPS input terminal.
4. Set the Input Function Switch to mA and read the input signal on the Input Display.

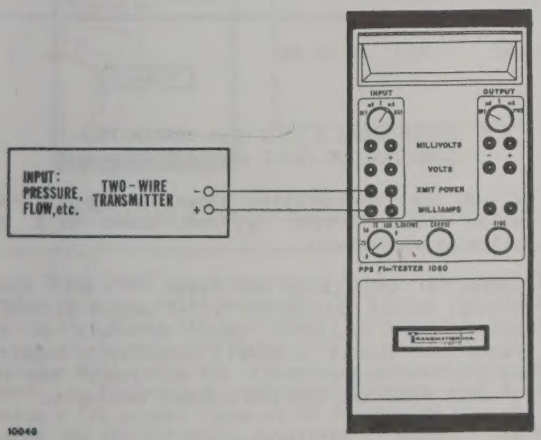

FIGURE 2-7
MONITORING AND POWERING A TWO-WIRE TRANSMITTER

In the configuration illustrated in Figure 2-7, the Model 1080's isolated unregulated 24 VDC supply can provide up to 60 mA to drive low power instruments in the process loop while monitoring the two-wire transmitter output.

NOTE: If the two-wire transmitter output loops is driven by an existing DC supply and does not require the Model 1080's internal voltage supply, connect the transmitter output to the MILLIAMPS input terminals (positive-to-positive and negative-to-negative) and DO NOT use the jumper as shown in Figure 2-7.

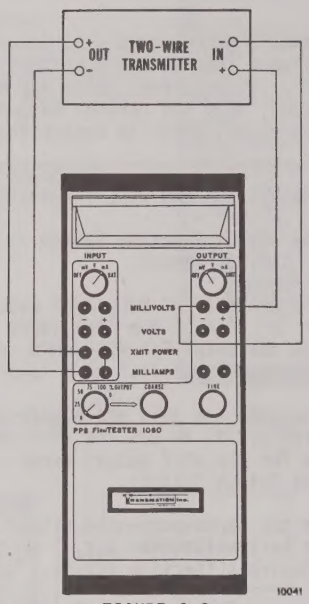

FIGURE 2-8a
CALIBRATING AND POWERING A TWO-WIRE TRANSMITTER
(SIMULTANEOUS INPUT/OUTPUT)

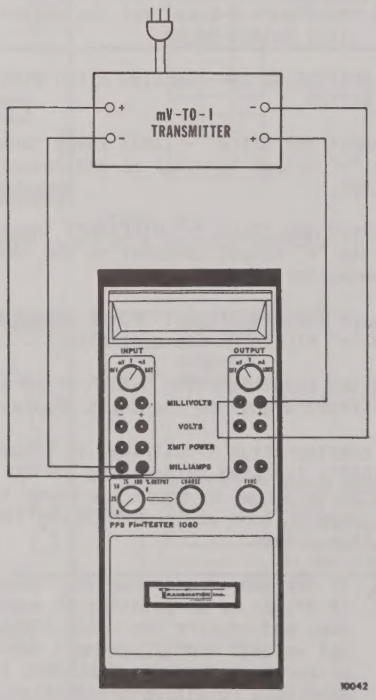

FIGURE 2-8b
CALIBRATING A FOUR-WIRE TRANSMITTER
POWERED BY AN EXTERNAL SUPPLY
(SIMULTANEOUS INPUT/OUTPUT)

2.5.6 CALIBRATING A TWO-WIRE TRANSMITTER - SIMULTANEOUS INPUT AND OUTPUT

1. Use the zero and full scale potentiometers (Section 2.2.4) to set the zero and full scale values for the output range to be selected (if using the Percent Output Switch).

2. Connect the appropriate Model 1080 output terminals to the two-wire transmitter's input terminals (positive-to-positive and negative-to-negative).

3. Connect the black "-" XMIT POWER terminal to the transmitter's "-" output terminal and connect the black "-" MILLIAMPS input terminal to the "+" output terminal.

4. Jumper the red "+" XMIT POWER and MILLIAMPS input terminals.

5. Set the Output Function Switch to the appropriate range and set the Input Function Switch to mA.

6. Use either the Percent Output Switch or the Coarse and Fine controls to adjust the test signal output.

7. Monitor the Model 1080 output on the Output Display and read the two-wire transmitter output on the Input Display.

NOTE: If the two-wire transmitter output loop is driven by an existing DC voltage supply and does not require the Model 1080's internal voltage supply, connect the transmitter output to the MILLIAMPS input terminals and DO NOT use the jumper as shown in Figure 2-8a. See Figure 2-8b below.

2.5.7 CALIBRATING A FOUR-WIRE TRANSMITTER - SIMULTANEOUS INPUT AND OUTPUT

To use the configuration shown in Figure 2-8b, follow the procedure outlined above with the following exceptions:

Instead of connecting the black "-" XMIT POWER terminal to the transmitter's "-" output terminal, connect both MILLIAMPS input terminals to the transmitter output terminals negative-to-negative and positive-to-positive. DO NOT jumper the red "+" XMIT POWER and MILLIAMPS input terminals.

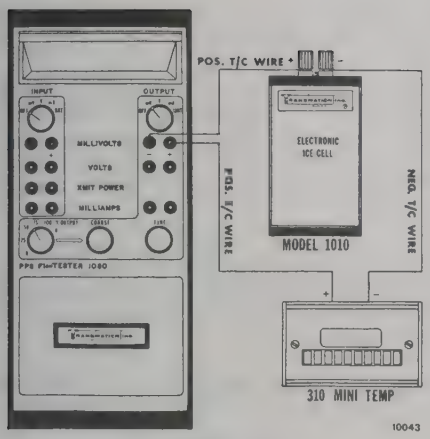

FIGURE 2-9a
CALIBRATING A THERMOCOUPLE INDICATOR

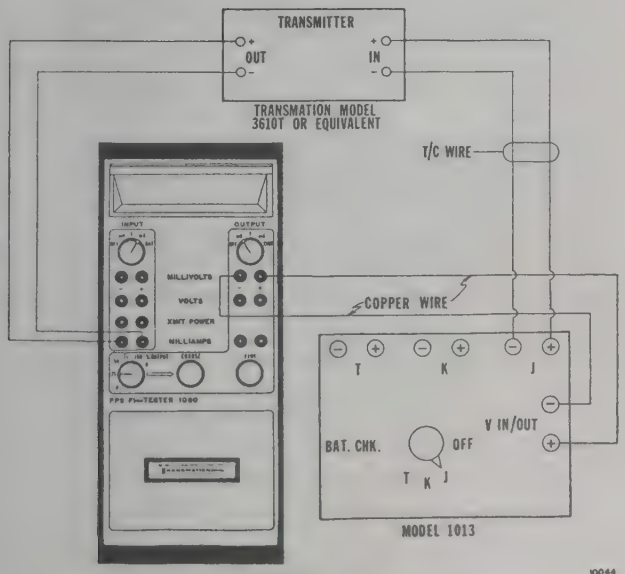

FIGURE 2-9b
CALIBRATING A THERMOCOUPLE TRANSMITTER

*Figure 2-9a shows the connections between the Model 1080, a Model 1010 Ice Point Reference Cell and a T/C indicator (Transmation Model 310 MiniTEMP®). Figure 2-9b shows the connections between the Model 1080, a Model 1013 Ice Point Reference Cell and a T/C transmitter (Transmation Model 3610T). In Figure 2-9b, the Model 1080 is being used to provide a T/C signal (type J) to the transmitter and to measure the transmitter's resulting mA output. The Model 1013 is recommended for applications with type J, K and T thermocouples. The Model 1010 is recommended for all other types of thermocouples. Consult the appropriate instruction manual for detailed information.

2.5.8 USING THE MODEL 1080 AS A THERMOCOUPLE SOURCE OR THERMOCOUPLE INDICATOR

The Model 1080 can be used to calibrate thermocouple (T/C) devices or measure T/C signals. When thermocouple-to-copper connections are made at any temperature other than 0°C (32°F), error is introduced into the measurement and/or signal. Therefore, it is recommended that an ice point reference cell such as the Transmation Model 1010 or 1013 be used to compensate for the ambient temperature at the Model 1080's input and/or output terminals. When an ice point reference cell is not available, the compensation required can be calculated and the measured and/or simulated signal be modified accordingly. This section describes how to use an ice cell with the Model 1080 and, as an alternative, how to calculate the required compensation. Thermocouple conversion tables that show the mV/temperature conversions for most T/C types are provided with the Model 1080.

2.5.8.1 USING THE MODEL 1080 AS A T/C SOURCE WITH AN ICE CELL

1. Use the thermocouple tables to determine the mV equivalent of the temperature signal to be simulated. If using the Percent Output Switch to adjust the Model 1080's output, determine the mV equivalents of both the zero and full scale temperature values, then set the zero and full scale pots on the Model 1080 (Section 2.2.4) accordingly.

2. Make the necessary connections between the Model 1080, the ice cell and the T/C device.* Note that the red T/C lead is negative and the color-coded T/C lead is positive.

3. Set the Model 1080's Output Function Switch to mV, and if monitoring an input as well (as shown in Figure 2-9b), set the Input Function Switch for the appropriate range.

4. Use either the Percent Output Switch (Section 2.2.3) or the Coarse and Fine controls (Section 2.2.5) to adjust the output to the mV equivalent(s) of the temperature value(s) determined in Step 1. Note that the 0% and 100% settings correspond to the zero and full scale values of the temperature range AND the mV range, whereas the 25%, 50% and 75% settings correspond to those percentages of the mV range only, NOT the temperature range. Therefore, use only the 0% and 100% settings to simulate T/C signals.

5. Monitor the mV output on the Model 1080's Output Display. If calibrating a thermocouple indicator such as the one shown in Figure 2-9a, a display is generally provided for monitoring the temperature. If calibrating a transmitter, the transmitter output (normally mA) can be monitored on the Model 1080's Output Display.

2.5.8.2 USING THE MODEL 1080 AS A T/C INDICATOR WITH AN ICE CELL

1. Make the necessary connections between the Model 1080, the ice cell and the thermocouple (see Figures 2-10a and 2-10b below). Connections to the Model 1080 are made at the MILLIVOLTS input terminals. Note that the red T/C lead is negative and the color-coded T/C lead is positive.

2. Set the Model 1080's Input Function Switch to mV and read the input signal in millivolts on the Input Display.

3. Use the thermocouple tables to convert the mV value to its temperature equivalent per T/C type.

2.5.8.3 SIMULATING A T/C WITHOUT AN ICE CELL

1. Connect the Model 1080's MILLIVOLTS output terminals to the T/C device under test using the appropriate type of T/C leads (see Figure 2-11a below). Connect the red T/C lead between the negative (-) terminals and the color-coded lead between the positive (+) terminals.

2. Use the thermocouple tables to determine the mV equivalent of the temperature signal to be simulated per T/C type being used.

3. Use an instrument thermometer to measure the ambient temperature at the MILLIVOLTS output terminals and convert the temperature to its mV equivalent per T/C type.

4. Subtract the mV value obtained in Step 3 from the mV value in Step 2.

5. Set the Output Function Switch to mV.

6. Use either the Percent Output Switch (see Step 4 on page 9) or the Coarse and Fine controls to adjust the mV output to the value obtained in Step 4.

7. Monitor the output on the Model 1080's Output Display.

EXAMPLE: Simulate a type J thermocouple signal of 337°F with an ambient temperature of 70°F.

T/C SIGNAL IN mV (STEP 2)		AMBIENT TEMP. IN mV (STEP 3)		COMPENSATED mV SIGNAL (STEP 4)
9.083 mV	-	1.076 mV	=	8.01 mV

2.5.8.4 MEASURING A THERMOCOUPLE SIGNAL WITHOUT AN ICE CELL

1. Connect the T/C leads to the Model 1080's MILLIVOLTS input terminals (see Figure 2-11b below). Connect the red T/C lead to the black "-" terminal and the color-coded T/C lead to the red "+" terminal.

2. Set the Input Function Switch to mV and read the mV value on the Input Display. Record the value.

3. Use an instrument thermometer to measure the ambient temperature at the Model 1080's MILLIVOLTS input terminals.

4. Use the thermocouple tables to convert the temperature value from Step 3 to its mV equivalent per T/C type.

5. Add the mV value in Step 4 to the mV value in Step 2.

6. Use the thermocouple tables to convert the resulting mV value in Step 5 to its temperature equivalent per T/C type.

EXAMPLE: Measure a type J thermocouple signal with an ambient temperature of 70°F.

STEP 2	STEP 4	STEP 5	STEP 6
VALUE DISPLAYED	AMBIENT TEMP. IN mV	COMPENSATED VALUE	ACTUAL T/C SIGNAL
8.01 mV	+ 1.076 mV	= 9.086 mV	= 337°F

USING THE MODEL 1080 AS A THERMOCOUPLE INDICATOR WITH AN ICE CELL

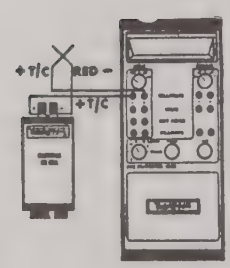

FIGURE 2-10a
USING A MODEL 1010

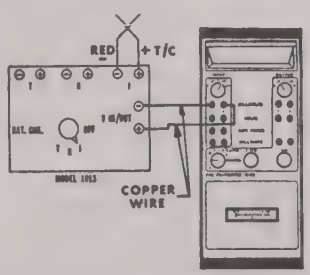

FIGURE 2-10b
USING A MODEL 1013

DIRECT THERMOCOUPLE CONNECTION

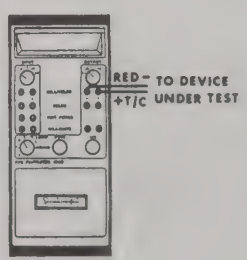

FIGURE 2-11a
SIMULATING A T/C
WITHOUT AN ICE CELL

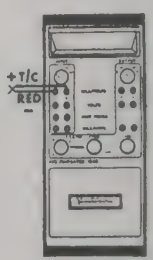

FIGURE 2-11b
MEASURING A T/C
WITHOUT AN ICE CELL

3. THEORY OF OPERATION

3.1 OVERVIEW

The Model 1080 is controlled by an Intel 8048 microcomputer. The microcomputer interprets the positions of the two front panel Function Switches (Input and Output) to set the Model 1080 for a particular mode of operation and signal range.

Each pair of terminals on the Model 1080 is equipped with a switching circuit (a series of relays) that turns the terminals on and off. The microcomputer applies an ENABLE signal to the appropriate switching circuit per the Function Switch settings. The ENABLE causes the selected circuit to conduct when a signal is applied to the corresponding pair of terminals. Two switching circuits (one input and one output) can be conducting at one time.

The Model 1080's analog-to-digital converter accepts mV level signals. All high level inputs (volts or mA) are converted to mV level signals at the input terminals prior to being applied at the A/D converter. Millivolt inputs, which do not require conditioning, are digitized by the A/D converter. The converter is reset by the microcomputer prior to each reading.

3.2 INPUTS

The analog input signals (mV level) are channeled to the analog-to-digital (A/D) converter and are converted to digital data. The A/D converter is reset by the microcomputer prior to each reading. To compensate for possible fluctuations in temperature by the A/D circuitry, the microcomputer periodically connects the A/D converter to a short circuit which provides a zero reference. If a change in temperature within the circuitry causes the reading to change, the zero reference reading (which is equally changed) is algebraically subtracted from the A/D converter value.

The data is entered as two 8-bit words. A DONE signal is sent to the microcomputer to indicate that the data is ready to be read and translated into engineering units (mV, V or mA). The data is then displayed on the input display window.

3.3 OUTPUTS

The output section generates a signal whose amplitude is determined by adjusting the output controls described in Section 2. Each internally generated signal is channeled to a dedicated set of output terminals. The signal at the output terminals is measured by the Model 1080 A/D converter. The instrument processes the internally generated signal as it would an externally generated signal. The value is indicated in engineering units on the output display window. At the output terminals, the signal undergoes the necessary signal conditioning prior to being applied to a test circuit.

3.4 POWER

Power is applied to the Model 1080's internal circuitry when one or both of the Function Switches are set at a range selection. The circuitry requires approximately 5 VDC. The microcomputer periodically checks the logic voltage. A low battery voltage is indicated by a flashing "CHARGE" message. If the voltage drops too low (below 4.5V), the unit automatically shuts off (see Sections 2.3 and 2.4).

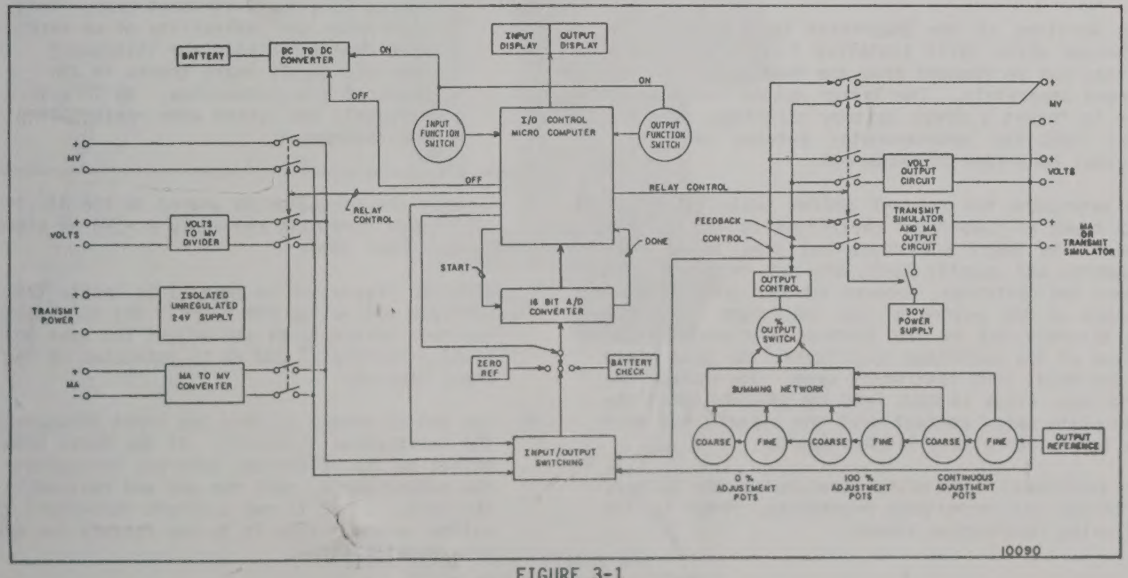

FIGURE 3-1
MODEL 1080 BLOCK DIAGRAM

4. MAINTENANCE/CALIBRATION

4.1 OVERVIEW

Field service procedures for the Model 1080 include replacing damaged external components, recharging or replacing the Snap-Pack® Battery Cartridge and periodic recalibration. Recalibration is NOT required more often than once a year under normal operating conditions due to the extremely low degree of long-term drift.

It is recommended that units requiring service beyond the scope of the procedures listed above be returned to the factory. Refer to the Factory Service and Warranty Statement on the back page for additional information.

4.2 SERVICING THE SNAP-PACK® BATTERY CARTRIDGE

The Model 1080 is powered by a Transmation Snap-Pack® Battery Cartridge. The Snap-Pack® cartridge contains rechargeable nickel-cadmium batteries that can be easily recharged or replaced as required. Two versions of the Snap-Pack® cartridge are available from Transmation. The AC Snap-Pack® (P/N 100785-000) is supplied with an AC charger transformer on a seven-foot power cord. A miniature power jack on the end of the cord plugs into the bottom of the AC Snap-Pack®, while the transformer plugs into an AC line outlet. The transformer must be specified for operation at 117 VAC @ 60 Hz (P/N 502226-069) or 230 VAC @ 50/60 Hz (P/N 502226-079). The DC Snap-Pack® (P/N 100724-005) is designed to fit in either of two Transmation charging stations: the Model 1001 Tilt-Base™ Charger or the Model 1004 4-Pack™ Charger. The Model 1001 Tilt-Base™ Charger permits the Model 1080 to be operated while its Snap-Pack® cartridge is being recharged. Continued operation of the Model 1080 in the Tilt-Base™ Charger does not drain the batteries.

Both versions of the Snap-Pack® cartridge can be recharged while still installed in the Model 1080 or they can be removed from the Model 1080 and recharged separately. The latter method permits the user to insert a fresh battery cartridge into the Model 1080 for uninterrupted service while its original cartridge is recharged.

The procedure for removal and/or installation of both types of Snap-Pack® cartridges is exactly the same. The Model 1080 does not have to be disassembled and special tools are not required. To remove the cartridge, squeeze the two quick-release latches on the bottom of the cartridge and slide the assembly out of the instrument chassis. The bottom of the cartridge constitutes the base plate of the Model 1080 instrument case. To replace the cartridge, slide it back into the chassis until the base plate makes contact with the chassis and push the two quick-release latches apart.

For additional information concerning the battery cartridge and recharging procedures, refer to the following instruction sheets:

Snap-Pack® Battery Cartridge, I.S. #100724-902

Model 1001 Tilt-Base™ Charger, I.S. #100724-903

Model 1004 4-Pack™ Charger, I.S. #100724-904

4.3 RECALIBRATION

To recalibrate the Model 1080 in the field, adjust the DVM span potentiometer as outlined below. If satisfactory results cannot be obtained by following this procedure, return the unit to Transmation for factory calibration.

EQUIPMENT:

- Screwdriver
- Precision mV Source - ±150 mV range, 0.01% accuracy
- 1/8" Allen Wrench

PROCEDURE:

1. Loosen the two Allen-head screws on the top of the instrument and remove the top plate.
2. Remove the Snap-Pack® Battery Cartridge (see Section 4.2).
3. Slide the rear panel of the instrument case off the chassis and remove the Nomex® paper jacket that covers the PC boards. Reinstall the Snap-Pack® cartridge.

> NOTE: The DuPont Nomex® paper jacket is installed to electrically isolate the PC boards from the instrument case. This eliminates the possibility of an excessive charge reaching the instrument case via the PC board traces in the event of a misconnection. Be sure to reinstall the jacket when reassembling the instrument.

4. Connect the precision mV source to the MILLIVOLT input terminals and apply a +150 mV signal to the Model 1080.
5. Refer to Figure 4-1 on page 13 to locate the DVM span pot on the DVM board. Set the Input Function Switch to mV and adjust the span pot until a reading of 150 mV is indicated on the Input Display.
6. Use the mV source to vary the input throughout the input range (±150 mV). If the Model 1080 maintains its calibrated accuracy throughout the entire range, seal the pot and reassemble the unit. If it is not accurate throughout the entire range, return it to the factory for precise recalibration.

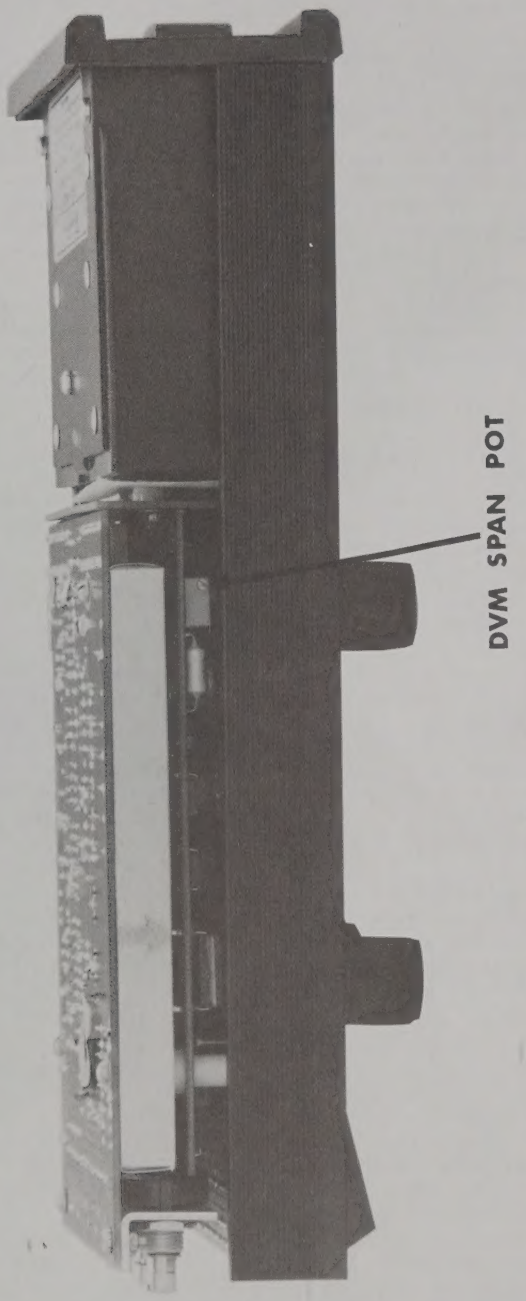

FIGURE 4-1
DVM SPAN POT LOCATION

FACTORY SERVICE AND WARRANTY STATEMENT

FACTORY SERVICE

Should service become necessary and field repair is inconvenient or undesirable, the instrument may be returned to the factory for repair or replacement as necessary. Please assist our factory service department by defining the symptoms precisely. Boards and/or instruments should be shipped prepaid via Air Parcel Post (Special Handling), UPS or other shipping means as the urgency of service requires, to:

Factory Service Department
Transmation, Inc.

Contact your representative for the nearest repair facility.

WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate and all repairs made by the Company to be free from defects in material or workmanship under normal use and service for a period of one year from the date of delivery to the Purchaser. Expendable items such as fuses, batteries, test leads, and carrying cases are not warranted. The Company will repair, at its option, without charge, F.O.B. Company's factory, any equipment or part thereof found to be defective in material or workmanship if such item is returned to Company's factory, transportation prepaid.

Limitation of Warranty and Liability

The liability of the Company (except as to title) shall in no case exceed the cost of correcting defects in products and shall not extend beyond one year from date of delivery. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery. The Company assumes no liability for the consequences of misuse of products by the Purchaser.

The foregoing is expressly in lieu of all other warranties whatsoever, express, implied, or statutory, including without limitation the implied warranties of merchantability and fitness for purpose. Any references by the Company to Purchaser's specifications and similar requirements is only to describe products, and no representation or other terms therein shall have any force or effect. Catalogs, circulars, and similar literature of the Company are issued for general information purposes only and shall not be deemed to modify the provision hereof.

The foregoing is the Company's only obligation and the Purchaser's only remedy for breach of warranty; and except for gross negligence, willful misconduct, and remedies permitted under any other clause of these Terms and Conditions, the foregoing is the Purchaser's only remedy hereunder by way of breach of contract, negligence or otherwise. In no event shall the Purchaser be entitled to incidental, special, or consequential damages. The Company does not authorize any agent or representative to warrant product fitness for any particular use or to make any other warranty, express or implied, or to assume any other liability, except as set forth herein.

Discrepancies in Shipment and Damage to Merchandise

Products manufactured by the Company are carefully packed and thoroughly inspected before leaving the Company's factory. Any claim for discrepancies will be honored only if reported within 15 days from receipt of shipment.

Responsibility for safe delivery of products is assumed by the carrier upon acceptance of the shipment. Consequently, claims for loss or damage sustained in transit must be filed with the carrier as follows: Written requests for inspection by the carrier's agent should be made within 15 days of the delivery date when concealed loss or damage is discovered. Concealed loss or damage means loss or damage which is not apparent until merchandise is unpacked; contents may be damaged in transit due to rough handling even though packaging may not show external damage. As to visible loss or damage, any external evidence of loss or damage must be noted on the freight bill or express receipt, and such document should be signed by the carrier's agent at the time of delivery. The Purchaser's failure to adequately describe such external evidence of loss or damage may result in the carrier's refusing to honor a damage claim. The carrier will supply a form for filing such a claim.

Miscellaneous

This Agreement shall be construed and interpreted under the laws of the State of New York. The parties hereby consent to the jurisdiction of the courts of the State of New York and agree that venue shall lie in Monroe County. The invalidity in whole or part of any provision hereof shall not affect the validity of any other provision.

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